CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1.   1.   A transceiver, comprising:

2   means for receiving a locally generated transmit signal;

3   means for coupling the locally generated transmit signal to a communication

4   medium, the means for coupling further coupled to a remotely generated receive signal;

5   and

6   means for recovering the remotely generated receive signal configured to reduce

7   both short-term echo components and long-tail echo components of the locally generated

8   transmit signal wherein the reduction of transmit signal echo is realized in a hybrid echo

9   canceller.

1.   2.   The transceiver of claim 1, wherein the means for recovering comprises a

2   multi-stage digital filter.

1.   3.   The transceiver of claim 2, further comprising:

2   means for determining the length in taps of the digital filter required to reduce the

3   short-term echo components; and

4   means for bifurcating the multi-stage digital filter responsive to the determination

5   means.

1.   4.   The transceiver of claim 2, wherein the multi-stage digital filter comprises

2   a dual-stage finite impulse response (FIR) filter.

1.   5.   The transceiver of claim 2, wherein the multi-stage digital filter comprises

2   a first stage that applies coefficients derived for each tap of the first stage and a second

3   stage that derives coefficient values for a subset of the taps of the second stage.

1   6.   The transceiver of claim 5, wherein the second stage applies a coefficient

2 value to each tap.

1   7.   The transceiver of claim 5, wherein the second stage derives coefficient

2 values for each Kth tap.

1   8.   The transceiver of claim 7, wherein the second stage uses an interpolation

2 scheme to determine coefficients to apply at each of the taps disposed between taps

3 associated with a derived coefficient.

1   9.   The transceiver of claim 8, wherein the second stage applies a coefficient

2 value at taps disposed between derived coefficients as a function of a coefficient value for

3 the last derived coefficient.

1   10.   The transceiver of claim 9, wherein the second stage applies the same

2 coefficient value at taps disposed between derived coefficients as the coefficient value for

3 the last derived coefficient.

1   11.   A method for reducing transmit signal echo in a digital transceiver,

2   comprising:

3   bifurcating a digital filter in response to the conversion rate of the filter tap

4   coefficients;

5   adaptively calculating and applying a filter tap coefficient to each tap of a first

6   stage of the bifurcated digital filter;

7   adaptively calculating a subset of the filter tap coefficients of filter taps in the

8   second stage of the bifurcated filter; and

9   applying an interpolation technique to identify the remaining set of filter tap

10   coefficients of the second stage.

1   12.   The method of claim 11, wherein the step of bifurcating the digital filter is

2   responsive to a digital subscriber line data transmission standard.

1   13.   The method of claim 11, wherein the step of adaptively calculating a

2   subset of filter tap coefficients determines a filter tap coefficient for the first tap of the

3   second stage of the bifurcated filter and every K^{th} tap thereafter.

1   14.   The method of claim 11, wherein the step of applying an interpolation

2   technique comprises determining a filter tap coefficient for each filter tap disposed

3   between calculated filter tap coefficients.

1   15.   The method of claim 13, wherein the second stage applies a coefficient

2   value at taps disposed between adjacent adaptively calculated coefficients as a function of

3   the coefficient value associated with an earlier encountered tap.

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1   16.   The method of claim 13, wherein the second stage applies the same

2   coefficient value at taps disposed between adaptively calculated coefficients as the

3   coefficient value associated with an earlier encountered tap with a calculated coefficient.

1   17.   A digital signal transceiver, comprising:

2   a transmitter configured to receive a locally generated transmit signal;

3   a hybrid electrically coupled to the transmitter configured to receive and

4   inductively couple the transmit signal to a two-wire transmission line, the hybrid further

5   configured to receive a remotely generated receive signal along the two-wire transmission

6   line;

7   a receiver configured to process the remotely generated receive signal; and

8   an echo canceller disposed in parallel between the transmitter and the receiver

9   configured to reduce both short-term echo components and long-tail echo components of

10   the locally generated transmit signal wherein the echo canceller calculates coefficient

11   values for less than N taps while emulating a N tap digital filter.

1   18.   The transceiver of claim 17, wherein the echo canceller comprises a

2   bifurcated digital filter that adaptively calculates and applies tap coefficients to each of a

3   plurality of filter taps in a first stage and adaptively calculates and applies a subset of tap

4   coefficient values to a plurality of filter taps in a second stage.

1   19.   The transceiver of claim 18, wherein the digital filter adaptively calculates

2   a tap coefficient value for a first tap of the second stage and every K^{th} tap thereafter.

1   20.   The transceiver of claim 19, wherein the digital filter interpolates the

2   calculated tap coefficient values for the second stage to identify coefficient values to

3   apply at taps disposed between taps associated with a calculated tap coefficient.

1 21. A method for reducing transmit signal echo in a digital transceiver,

2 comprising:

3 means for bifurcating a digital filter in response to the conversion rate of the filter

4 tap coefficients;

5 means for deriving and applying a filter tap coefficient to each tap of a first stage

6 of the digital filter;

7 means for adapting a subset of coefficients each associated with a particular filter

8 tap in the second stage of the filter, the subset of coefficients comprising less coefficients

9 than the number of filter taps in the second stage of the filter; and

10 means for interpolating at least one coefficient value intended for application at a

11 filter tap not associated with an adapted coefficient of the second stage of the filter.

1 22. The method of claim 21, wherein the means for bifurcating is responsive

2 to a digital subscriber line data transmission standard.

1 23. The method of claim 21, wherein the means for adapting a subset of

2 coefficients determines a filter tap coefficient for a first tap of the second stage of the

3 bifurcated filter and every K^{th} tap thereafter.

1 24. The method of claim 21, wherein the means for interpolating comprises

2 determining a filter tap coefficient for each filter tap disposed between adapted filter tap

3 coefficients.

1 25. The method of claim 23, wherein the second stage of the filter applies a

2 coefficient value at filter taps disposed between K^{th} adapted filter taps as a function of the

3 coefficient value associated with an earlier encountered tap.

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1   26.   The method of claim 23, wherein the second stage of the filter applies the

2 same coefficient value at taps disposed between K^{th} adapted filter taps as the coefficient

3 value associated with an earlier encountered tap with an adapted coefficient.